

Automated Valuation Testing



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Introduction

Given the new regulatory guidelines on AVMs, many AVM users and prospective users have questions about the best way to perform independent validation of AVM results. CoreLogic® is not a regulator and we cannot provide compliance advice. The purpose of this document is to share our thoughts on AVM testing best practices, which may be used to help guide research and discussions with regulators on the right approach for each institution.

Regulated institutions' AVM testing, cascade creation and use of model results for lending purposes have been governed by specific regulatory guidelines for many years. AVM use was again addressed in the December 2010 guidance issued simultaneously by the various federal banking regulators entitled the "Interagency Appraisal and Evaluation Guidelines" (the "Interagency Guidance" or the "Guidance"). The Interagency Guidance affirmed a place for AVMs in lending policies:

"An AVM may be used for a transaction provided the resulting evaluation meets all of the supervisory expectations in the Evaluation Development and Evaluation Content sections in the Guidelines, is consistent with safe and sound banking practices, and produces a credible market value conclusion."¹

The Interagency Guidance applies to institutions regulated by the OCC, FDIC, OTS, Federal Reserve, and NCUA. The 2010 Interagency Guidance is a lengthy document which expands on previous guidelines to cover many aspects of AVM use including vendor selection, AVM model development, testing, and monitoring. Many of our clients are considering how to best comply with the provisions of the statement above. The scope of this document is limited to best practices around selecting and validating AVM results. We have services available to address other topics contained in the Interagency Guidance such as property condition, local market conditions, and risk management tools. Please ask your CoreLogic representative or visit corelogic.com for more information.

The Interagency Guidance can seem overwhelming and it may be tempting to seek a vendor with "compliant" products. Unfortunately, no AVM provider can claim that a specific model, AVM cascade or research approach is "compliant with regulations" because regulators are also interested in risk policies, product testing and use. That said, CoreLogic AVMs and AVM cascades are used by regulated institutions large and small. A number of these institutions have shared with us that their examiners have found the institution's use of CoreLogic AVMs and AVM cascades to comply with all applicable regulations.

¹ Interagency Appraisal and Evaluation Guidelines, 75 Fed. Reg. 77,450, 77,453 (Dec. 10, 2010). The Interagency Guidance was issued jointly by the OCC, FDIC, OTS, Federal Reserve, and NCUA.

Before You Test

One of the first questions to ask before you test an AVM is, “What level of testing rigor is required given my institution’s use of AVMs?” The Guidance provides that an institution may not rely solely on the results of an AVM to develop an evaluation unless the resulting evaluation is consistent with safe and sound banking practices and the requirements in the Guidance. Much of the Guidance refers primarily to AVMs used as a component of an “evaluation” (as that term is defined in the Guidance) for sole collateral support in a lending decision. If your organization uses AVMs for portfolio management, marketing, appraisal review or some other purpose, you may wish to communicate with your regulator regarding regulatory expectations.

Assuming that the more rigorous testing guidelines apply to your AVM program, review of the AVM program actually begins before the AVM testing starts. First, the institution must determine the circumstances under which an AVM can be used as the basis of an evaluation. This is discussed on pages 77,468 – 77,469 of the Interagency Guidance under the headings of “Selecting an AVM(s)” and “Determining AVM Use”. This section addresses written policies independent of AVM test results. Here are several key policy questions to consider:

- ▶ What expertise is required by staff that performs AVM testing?

Many institutions leverage people who have performed analysis or reporting for other risk-based decisions such as setting LTV limits or selecting a mortgage fraud tool.

- ▶ What will your process be for testing AVMs? How frequently? Do you have any specific criteria for your provider?
- ▶ As you contemplate some of these questions, you may decide on criteria for any model you will purchase, regardless of performance. A few examples of consideration criteria are below:
 - ◆ AVMs must supply a forecasted standard deviation along with the AVM result so that the model error can be objectively understood and compared across models;
 - ◆ AVM providers must make available quarterly internal testing based on a comprehensive blind-testing protocol; and
 - ◆ AVM providers must make reasonable use of listing information such that a list price does not have too great an influence on the AVM value.

- ▶ What program guidelines apply when you permit an AVM to be used as sole collateral support? Will you have a confidence score cutoff?

Many clients have specific underwriting criteria such as LTV and FICO cutoffs. It is also common for institutions that require a forecast standard deviation to further require that only model results with a forecasted standard deviation under 0.25 are acceptable.

- ▶ What market events would cause you to alter your AVM program?

For example, many clients use CoreLogic platforms and services to restrict AVM use in areas with natural disasters and areas with a high incidence of fraud.

- ▶ What happens if the first AVM fails one of your criteria?

How will you ensure that calls for a second value are not simply for the purpose of “value shopping?” Many clients leverage the GeoAVM Precision™ cascade which will only return a single AVM result. CoreLogic platforms have similar settings for clients who establish their own cascade logic.

- ▶ What are your basic standards for valuation accuracy and how will you ensure this through testing? Do your accuracy criteria vary by geography or transaction?

CoreLogic recommends that accuracy thresholds be set prior to testing. Choosing the “best” AVM is irrelevant if no AVM meets your accuracy threshold. Examples of accuracy thresholds include: AVM median error must be no greater than X; or at least Y% of AVM values must fall within 20% of the benchmark in national testing. Some clients have different thresholds depending on the CLTV of the loan.

- ▶ What other information do you need at the time an AVM is used? Does this vary by loan risk or geography?

Given new comments on property inspections, many clients are now reviewing an inspection report and local market condition report prior to approving the AVM for use. Although this adds a step and expense to the program, it is still more timely and less costly than obtaining a full appraisal. CoreLogic property and market condition reports can be seamlessly ordered upon confirmation that an AVM has passed all hurdles for accuracy.

Once all of the policies have been established, testing can proceed. See Appendix B for top questions we recommend you ask AVM providers.

Selecting an AVM

The Interagency Guidance states:

“An institution should establish standards and procedures for independent and ongoing monitoring and model validation, including the testing of multiple AVMs, to ensure that results are credible. An institution should be able to demonstrate that the depth and extent of its validation processes are consistent with the materiality of the risk and the complexity of the transaction.”²

CoreLogic, for example, provides quarterly internal model testing results on our four models and four cascades to clients upon request. Every day, we blind test our AVMs against the prior day’s recorded property sales. We consolidate the daily test results into quarterly reports³. Our testing is comprehensive and provides transparency into how we manage our model performance. However, we are the provider of the model and are, by definition, not “independent”. The Interagency Guidance further states:

“An institution should not rely solely on validation representations provided by an AVM vendor.”⁴

Note that the Guidance does not say that vendor-provided test results are to be ignored, only that they cannot be your only measure of AVM performance. Institutions must gather information on the performance of AVMs from someone other than the vendor. The Collateral Assessment and Technologies Committee⁵, of which CoreLogic is a member, issued comprehensive best practices recommendations for AVM testing in 2009. This document, which can be found in Appendix A, covers all aspects of testing, from establishing a test sample to evaluating AVM results to the terms that should be included in a testing agreement.

The Interagency Guidance provides six tenets for model selection:

- (1) *“Perform the necessary level of due diligence...including how model developers conducted performance testing as well as the sample size used and the geographic level tested.”*
- (2) *“Establish acceptable minimum performance criteria for a model prior to and independent of the validation process.”*
- (3) *“Perform a detailed validation of the model(s) considered during the selection process and document the validation process.”*
- (4) *“Evaluate underlying data used in the model(s), including the data sources and types, frequency of updates, quality control performed on the data, and the sources of the data in states where public real estate sales data are not disclosed.”*
- (5) *“Assess modeling techniques and the inherent strengths and weaknesses of different model types (such as hedonic, index, and blended) as well as how a model(s) performs for different property types (such as condominiums, planned unit developments, and single family detached residences).” and*
- (6) *“Evaluate the vendor’s scoring system and methodology for the model(s). Determine whether the scoring system provides an appropriate indicator of model reliability by property types and geographic locations.”⁶*

Only regulators can determine what qualifies as a “detailed validation”. The Interagency Guidance contains a “Validating AVM Results” section, and our recommendations and best practices on that area are covered in the next section. CoreLogic provides extensive documentation on how we conduct performance testing. We disclose the sample size used and break out results by geography. CoreLogic also provides clients, upon request, a document titled “Detailed Description of

² Interagency Guidance, 75 Fed. Reg. at 77,469.

³ CoreLogic has a patent-pending testing protocol, which is detailed in the paper “Innovations in AVM Testing” available from your CoreLogic representative or on our website corelogic.com.

⁴ Interagency Guidance, 75 Fed. Reg. at 77,469.

⁵ CATC is a subcommittee of the Real Estate Information Professional Association (REIPA.)

⁶ Interagency Guidance, 75 Fed. Reg. at 77,468–77,469.

CoreLogic AVMs” which provides extensive commentary on the topics noted above, and more. In addition, CoreLogic provides the methodology documentation for each of our four AVMs and four AVM Cascades. Assessing the confidence scoring system is something that can easily be performed as part of AVM testing.

There are many ways to measure the accuracy of model results. The method you select will determine what errors are known to you, and which are unknown. There is no perfect accuracy measure for AVMs. As a result, many institutions examine multiple measures.

STANDARD ACCURACY MEASURES

Measure	What it measures	Caveats
Mean (Average) Error	Model Bias – If you value all properties, the mean error represents the extent of overvaluation or undervaluation in the entire pool. This is a good measurement to consider for a portfolio application.	Outliers significantly skew the results, especially if your sample size is small.
Median Error	Model Bias with Outliers Neutralized – median is literally the valuation error that is exactly in the middle of all valuation errors.	Outliers matter, especially in origination decisions.
Standard Deviation	Standard Deviation measures the distribution of errors around the mean.	Standard deviation is calculated around the mean, not around an error of “0”. So a low standard deviation can mask high error rates. Also, the definition of standard deviation only holds if the underlying data set is normally distributed. AVM error rates are typically not normally distributed because they have a lower bound of 0 but no upper bound.
Square Root of Mean Squared Error	Measures distribution of errors around “0”.	Better than Standard Deviation but still has the issues of losing its definition when applied against non-normal data such as AVM error rates.
Percent Predicted Error within 10% (PPE 10)	The percent of model results that had an error within a specific tolerance. PPE10, PPE15, and PPE 25 are commonly used metrics for AVM testing. They do not require the data to be normally distributed, and they mean exactly what they say.	PPE is binary – either a valuation result is within the threshold or it’s not. The extent of error is irrelevant. So an AVM result that is off by 30% is measured the same as an AVM result that is off by 100%, even though the effect on risk management is significantly different.
Percent Predicted Error over 25%	The percent of model results that overvalue the benchmark by more than 25%. This is an important metric for lending because it is an indication of extreme overvaluation.	Same caveats as PPE 10.

Originally, AVM testing was performed to select one model for use. Now, it is common for lenders to use multiple AVMs in a cascade. Any time models are blended, the resulting output is its own model with unique characteristics. CoreLogic issued a white paper titled “The Role of Conditional Logic in AVM Cascade Creation” describing the importance of creating a cascade using an iterative approach that mimics what actually happens in production.

In addition to our own opinions on what makes a good cascade, CoreLogic sponsored New York University professor Andrew Caplin in a research program to identify cascade approaches used in our industry and identify the pros and cons of each. Professor Caplin found that,

“Use-based [cascades] are superior when the AVMs ... have distinct “areas of expertise” (e.g. Orange County as opposed to Queens County).”

Professor Caplin found that the iterative approach supported by CoreLogic is the optimal cascade method where there are measurable differences in AVM performance by county (which is why most clients want to cascade AVMs in the first place.) Both papers can be downloaded at corelogic.com/Products/GeoAVM-Cascade-Suite.aspx.

Validating AVM Results

Of all the obligations surrounding use of AVMs, the actual validation is perhaps the least complex. Many CoreLogic clients find that once they perform AVM testing in-house, the process is easily repeatable and they can enjoy the benefits of in-house AVM expertise.

Regarding Requirements for Validating AVM Results, the Interagency Guidance states:

“In the AVM validation procedures, an institution should specify, at a minimum:

- ▶ *Expectations for an appropriate sample size.*
- ▶ *Level of geographic analysis.*
- ▶ *Testing frequency and criteria for re-testing.*
- ▶ *Standards of performance measures to be used.*
- ▶ *Range of acceptable performance results.*

To ensure unbiased test results, an institution should compare the results of an AVM to actual sales data in a specified trade area or market prior to the information being available to the model. If an institution uses more than one AVM, each AVM should be validated.”⁷

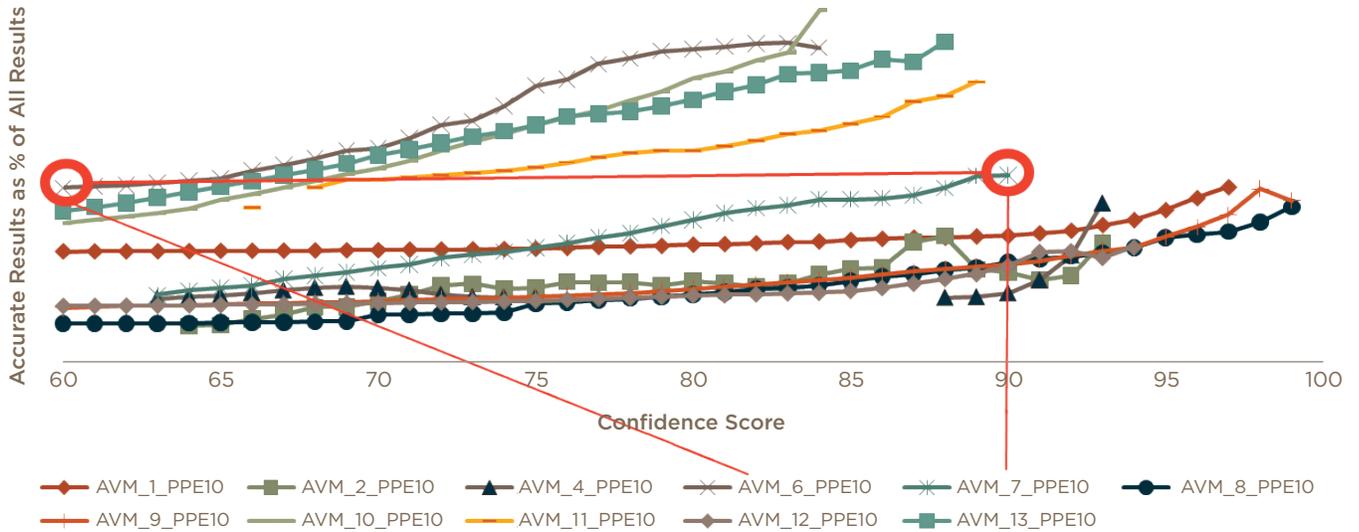
The expectations for sample size are up to the institution and regulator to determine. A number of our AVM clients have shared with us that they have satisfied their regulators by performing routine testing against their first mortgage pipeline. This entails compiling a file with the addresses and sale price of recently closed (or soon to close) purchase transactions. The file is provided to CoreLogic, for example, without values to the AVM provider, and we append the AVM results. If the client desires a larger test sample, then they continue to collect test data until they have achieved the agreed-upon sample size. An alternative of testing over a longer period of time is to “fill in” data by obtaining recorded sale transactions from a third party provider, such as CoreLogic. In this case, CoreLogic provides the client a file of recently closed transactions in the client’s footprint, along with the CoreLogic AVM values for the client to test.

This is a very common testing approach. CoreLogic has a process to ensure that the AVM does not use the appended sale price in our model results when we are also providing the transaction benchmark. Regardless of the data source used, the client calculates the AVM performance according to the performance measures the client has determined to be optimal for their use. Most common calculations such as mean, median and absolute value are functions in Excel. Data analysts proficient in Excel can use pivot tables to create geographic breakdowns of the data, depending on the client’s loan portfolio. It is common for AVMs to perform best at prices closest to the median home price in a county. Rather than setting up different price tiers, many clients use their AVM research to establish upper and lower boundaries for AVM use (\$100,000 and \$1,000,000 are common lower and upper boundaries, outside of coastal areas).

⁷ Interagency Guidance, 75 Fed. Reg. at 77,469.

We also advise clients to test the confidence scores. Some clients test the scores in “buckets” and some test at discrete intervals. Whichever you choose, apply your preferred accuracy metric to each interval. For example, many clients plot the rate of AVM overvaluation (say the AVM is 25% or more too high) for each interval. Then the client establishes a confidence score cutoff commensurate with their overvaluation tolerance. Here is a sample confidence score chart showing performance as measured by the percent of results within 10% of the benchmark for several industry models. Each model was scored using their “legacy” confidence scores ranging from 0–100 ⁸. This chart, based on CoreLogic data, is provided for illustrative purposes only.

CUMULATIVE ACCURACY BY CONFIDENCE SCORE



⁸ Note that the accuracy of AVM_6 at a confidence score of 60 is the same as the accuracy of AVM_7 at a confidence score of 90. It is for this reason that some clients now require their AVM provider to use a forecast standard deviation as a confidence score.

Validating a Cascade

If a client is using a cascade, then all component models and the cascade result must be tested. CoreLogic can easily facilitate this for our GeoAVM Core™ and GeoAVM Precision cascades. We simply add the cascade results to the output file for clients to process similarly to the individual model results.

If desired, CoreLogic can discuss with the client any differences between CoreLogic test results and client test results. This increases the client's understanding of how the CoreLogic AVMs work and where model results may not be well suited for the client's needs.

CoreLogic clients occasionally do engage third party AVM testing services. CoreLogic participates in AVM testing with several such services in support of our mutual clients. See Appendix C for contact information for some third party AVM testing services, as well as recommended questions for evaluating AVM testing services.

Before engaging a third party, be aware that the Guidance states:

“Prior to entering into any arrangement with a third party for valuation services, an institution should compare the risks, costs, and benefits of the proposed relationship to those associated with using another vendor or conducting the activity in-house. The decision to outsource any part of the collateral valuation function should not be unduly influenced by any short-term cost savings. An institution should take into account all aspects of the long-term effect of the relationship, including the managerial expertise and associated costs for effectively monitoring the arrangement on an ongoing basis. If an institution outsources any part of the collateral valuation function, it should exercise appropriate due diligence in the selection of a third party. This process should include sufficient analysis by the institution to assess whether the third party provider can perform the services consistent with the institution's performance standards and regulatory requirements. An institution should be able to demonstrate that its policies and procedures establish effective internal controls to monitor and periodically assess the collateral valuation functions performed by a third party.”⁹

Although the decision to engage a third party provider may address some compliance concerns, the institution must establish additional protocols around third party vendor management to ensure that any services provided by a third party comply with applicable laws and regulations and are consistent with supervisory expectations.

⁹ Interagency Guidance, 75 Fed. Reg. at 77,463.

Follow-Up after Testing is Complete

Regardless of who performs AVM testing, there is additional follow-up contemplated in the Interagency Guidance:

“To assess the effectiveness of its AVM practices, an institution should verify whether loans in which an AVM was used to establish value met the institution’s performance expectations relative to similar loans that used a different valuation process. An institution should document the results of its validation and audit findings. An institution should use these findings to analyze and periodically update its policies and procedures for an AVM(s) when warranted.”¹⁰

Most CoreLogic clients monitor both the performance of their AVM solution and the performance of loans originated where the AVM was the sole collateral support. In fact, clients routinely report that their AVM-based loans perform very well compared with expectations, even through the mortgage crisis.

Whether you conduct your own testing or outsource it to a third party, know that CoreLogic stands with you. We will continue to produce detailed reports on our methodologies, testing, and model performance.

¹⁰Interagency Guidance, 75 Fed. Reg. at 77,469.

Appendix A — Best Practices in Automated Valuation Model (AVM) Validation

The Collateral Assessment and Technologies Committee issued comprehensive best practices recommendations on AVM testing in 2009. This document covers all aspects of testing, from establishing a test sample to evaluating AVM results to the terms that should be included in a testing agreement. CATC is a subcommittee of the Real Estate Information Professional Association (REIPA.)

A copy of this paper is available at corelogic.com/avmvalidation.

Appendix B – Recommended Key Questions for AVM Providers

1. What are your primary data sources? How many counties does each data source cover? How many counties does your AVM cover?

Considerations: For clients with a national footprint, it is important to source AVMs from vendors with robust coverage. It is important to be specific about this question, because it is perfectly legitimate for a vendor to claim “national” coverage even though their most important data sources cover a limited number of counties. Given the limited transactions and heterogeneity of housing stock in sparsely populated rural counties, no AVM will reliably cover all counties. However, it is important to find a provider dedicated to serving the largest coverage area possible, rather than one who just provides service in the areas that are easiest to value.

2. How do you use each data source? How do you manage the data?

Considerations: There are many potential sources of data for AVMs – public records, mortgage records, lender-supplied transaction data, MLS data, tax assessment records, etc. None of these sources are unequivocally “good” or “bad.” However, it is important to know how each is used in the model. For example, a model based on multiplying a list price by the average list-to-sale ratio will probably test accurately against national sales. But it would not work well on refinance transactions, and a fraudster could evade detection by simply listing a property above its true value. Public record data is tricky in non-disclosure states. Tax assessment records are unreliable estimates in states such as California that have imposed limits on value changes.

Data management is another important component of any AVM vendor’s product. How does a vendor manage inconsistencies among different data sources? How does a vendor identify errors in the data? Although this may seem trivial, it is no coincidence that providers with strong data management also tend to create the best performing models.

3. How often do you refresh your data and recalibrate your model? What triggers model recalibration? How do you ensure consistency between model versions?

Considerations: Data refresh refers to the updating of information on property values within the model. All vendors have the option of obtaining and refreshing data daily, but data refresh is an expensive and time consuming process. Many providers therefore opt for a less frequent refresh cycle. At a time when home price valuation changes are volatile, failing to refresh data frequently can impact AVM performance.

Model recalibration refers to updating the model. Here, the frequency may not be as important as the trigger. What information does a vendor use to determine that the model needs to be recalibrated? Is it recalibrated when markets change? By how much? Is it recalibrated in response to customer requests? If not managed correctly, model changes can result in significant inconsistency in AVM results over time.

4. How do you test the performance of your AVM? Is your test data produced from the same system used in production?

Considerations: The best way to test AVMs is to value properties before a sale occurs, then compare the AVM result to the actual sale. Because we do not know what properties will sell in the future, serious AVM developers must value the entire residential market on a continuous basis so that a recent value is available when a sale is recorded. Even better, the AVM developer would store all of the AVM values and match the recorded sale with an AVM as of the sale date, not the recording date. With nearly 90 million residential properties in the US, it is no small task to value the national stock on a continuous basis. But it is the most comprehensive way to test the accuracy of AVMs.

It is also important that AVMs are tested using the same system used in production. It is not uncommon for vendors to produce test AVMs from a batch or staging system that is different from the production system. Although this may help vendors manage production load, it can lead to inconsistencies between test results and production results. A strong vendor has capacity to process testing from their production system.

5. How has your model performed in recent tests? Major lenders often use multiple AVMs in cascades. What is the highest percentage your model earned in a major lender's cascade? Would this lender be willing to serve as a reference for you?

Considerations: AVM testing is routine. There are services that perform AVM testing either to supplement lender testing or outsource the process. The largest lenders all perform internal testing and use multiple AVMs based on where each performs best. Each vendor should be able to comment on their model's performance relative to competitors. As with other questions, it is good to be as specific as possible. Comments such as "our clients include all of the top 10 lenders" may mask the fact that the model only earns a 2% share of these banks' business. And, "We tested as the most accurate model" may really mean, "We tested as the most accurate AVM in Fargo on properties valued between \$225,000 and \$250,000 – but we were dead last everywhere else."

6. How many AVMs do you produce each month? What is your turn-around time for a 1 million record batch?

Considerations: Performance is paramount. But what good is a great AVM if it runs too slowly or suffers from persistent timeouts? And what happens when you have an urgent need to value a large portfolio? It's good to evaluate up front whether a vendor can meet your needs. For reference, CoreLogic processes over 1 billion AVMs each month.

7. Describe your data center's capabilities for processing, fail-over, and data recovery.

Considerations: When users are testing an AVM, it is easy to forget technology. The issue only comes to light when there is a major failure impacting processes and key decisions. If AVMs are a critical part of the loan production or servicing process, it is important to use a vendor whose data center is robust and reliable.

8. What are the credentials of the AVM development team?

Considerations: Ideally, the AVM development team will include experienced modelers and resources with real estate data and appraisal expertise. It is a good idea to also ask about the team's tenure at the company and examine the development team's bench strength. Is there any "key person" risk? Do you believe the development team understands enough about real estate and modeling to maintain a solid model in the face of changing markets?

9. What improvements have you made to your AVM model or infrastructure in the past year?

Considerations: Data, technology, modeling approaches and real estate markets are continuously evolving. It is best to have an AVM partner that is continuously evolving too. Updating data and recalibrating a model are not "innovations". Has the provider created a new approach relevant in markets where REOs are now the predominant transaction? How about condominium values? Has the AVM report changed to provide users with more pertinent information? Whatever the innovation, it is important to have a partner that is continuously developing improvements.

10. In addition to AVMs, what other analytic services does your company offer? How successful have those offerings been in the marketplace?

Considerations: This is another broad measure of strength. Companies with exceptional data, robust technology and talented development teams will also likely develop other successful analytic products such as mortgage fraud and risk models. It is good to have a collateral analytics partner whose understanding of risk is broader than a point-in-time property valuation.

Appendix C – Third Party Testing Services¹¹

Contact Information

AVMetrics, LLC
650 Cochran St. Suite 10
Simi Valley, CA 93065
avmetrics.net

Southwest Financial Services, Ltd.
537 East Pete Rose Way, Suite 300
Cincinnati, Ohio 45202
<https://sfsltd.com/www/index.html>

Recommended Key Questions for AVM Testing Services Providers and Cascade Developers

1. How soon after the sale is recorded do you obtain the AVMs?

Considerations: Days matter. If there is a lag between the time the sale is recorded and the AVM is obtained, the AVM database may have already populated the sale data from another source. AVM refresh schedules vary by vendor, so some models are more likely to have “fresh” data than others.

2. Does your treatment of stale records disqualify top AVMs?

Considerations: If the test data is stale, one “solution” is to remove from the test set any AVM result where the AVM vendor reports that they already know about the reference value. This is a good option and common practice. There are two ways to disqualify values:

- i. Remove observation values only for the models that report knowing about the reference value. This keeps the maximum number of overall observations in the test data, but it skews the performance results in favor of models that are slowest to update their records. With this type of testing, models with fresh data appear to be lower performers. Also, this approach results in comparing models on different data sets.
- ii. Disqualify ALL model results if ANY model has the reference value in their database. This is the preferred approach because all models are valuing the same properties.

3. How do you blend AVMs to create a cascade?

Considerations: Many cascades are established by rank ordering the AVMs based on model performance. Unfortunately, this practice does not account for the fact that secondary models are only valuing those properties that could not be valued by the models called before them in the cascade.

Sometimes the “best” model to have in second place is NOT the AVM that ranked second in performance. Rather, it is the model best able to value those properties that the first AVM missed. There are a number of reasons why some models may be better complements to other models – different data, different valuation approach, etc.

4. What performance can I expect from the cascade as a whole?

Considerations: It is not possible to estimate the cascade performance by looking only at the individual AVM performance. Users must perform a second round of validation testing on the cascade itself (taking into consideration secondary hits) in order to set expectations of cascade performance.

¹¹ Information on third party AVM testing service providers is furnished for informational and convenience purposes only. Before choosing a third party service provider you should perform your own due diligence and select a provider only after your due diligence is complete. CoreLogic does not any endorse any third party service providers.

5. How will I know when an input model or the cascade has deteriorated?

Considerations: Monitoring is an important part of using cascades. After the cascade has been established and tested, it is necessary to monitor whether the actual production results are in line with the validation test. Inevitably, cascade and individual model results will change over time. Cascade updates should be triggered based on these changes (or at regularly-scheduled intervals as required by regulation.)

6. How can you help me monitor real-time production?

Considerations: There are various methods of monitoring cascade performance over time:

- i. Additional testing on non-production data – this is the least effective method because the test data is not consistent with production, but at least you can tell whether the models seem to be performing similar to the last test round.
- ii. Periodic testing against production data – this is a good spot-check.
- iii. Consistent testing against production data – this is the gold standard. Model performance (or technical issues such as time-outs) are quickly identified and can be quickly resolved.

7. How do you manage “exception” properties such as REOs?

Considerations: AVMs are designed to presume that properties are in average condition for their market, and that sales are arms-length. As a result, some properties and transactions are not well suited for automated valuations. Testing and implementation strategies should take into consideration the following:

- ▶ Properties with a high probability of fraud
- ▶ Non-arms-length transactions
- ▶ REO or other evidence of distress
- ▶ Properties that are not SFR, PUD or Condo
- ▶ Properties significantly affected by natural disasters

About CoreLogic

CoreLogic (NYSE: CLGX) is a leading provider of consumer, financial and property information, analytics and services to business and government. The company combines public, contributory and proprietary data to develop predictive decision analytics and provide business services that bring dynamic insight and transparency to the markets it serves. CoreLogic has built the largest and most comprehensive U.S. real estate, mortgage application, fraud, and loan performance databases and is a recognized leading provider of mortgage and automotive credit reporting, property tax, valuation, flood determination, and geospatial analytics and services. More than one million users rely on CoreLogic to assess risk, support underwriting, investment and marketing decisions, prevent fraud, and improve business performance in their daily operations. The company, headquartered in Santa Ana, Calif., has more than 10,000 employees globally with 2010 revenues of \$1.6 billion. For more information visit corelogic.com.

CoreLogic
4 First American Way
Santa Ana, CA 92707

FOR MORE INFORMATION PLEASE CALL 1-866-774-3282

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